REMARKS

Reexamination and reconsideration of this application is respectfully requested in light of the foregoing amendment to claim 1 and the following remarks.

Claims 1, 3, 8 and 10-14 are pending in this application. Claims 2, 4-7 and 9 were previously canceled without prejudice or disclaimer. Applicant notes the Examiner's holding that the election was made without traverse.

Claims 10-14 have been withdrawn from consideration due to a restriction requirement. No new claims have been added. Claim 1 has been amended. By this amendment, no new matter has been added to the application. Support for the amendment to claim 1 can be found at p. 12, lines 16-18.

Applicant notes the Examiner's acknowledgment of Applicant's claim for foreign priority under 35 U.S.C. § 119 and receipt of the certified priority document as well as acceptance of the drawings filed January 16, 2004.

Rejections of Claims 1, 3 and 8

Claims 1, 3 and 8 stand rejected under 35 U.S.C. § 103(a) as being unpatentable over Tanaka et al. (English abstract of Japanese Publication No. 402197550) alone or in view of Ishii et al. (European Publication No. 0 639 691) and Hamada et al. (English abstract of Japanese Patent Publication No. JP407233450). The same claims stand rejected under 35 U.S.C. § 103(a) as being unpatentable over Hamada et al. (English abstract of Japanese Patent Publication No. JP407233450) alone or in view of Ishii et al. (European Publication No. 0 639 691). For the reasons set forth below, Applicant respectfully traverses these rejections.

The present invention is directed to a steel having improved high temperature strength, high creep rupture strength, and reduced brittleness at high temperatures. To achieve these properties, independent claim 1 requires that the square of the difference between the amount of Ni and the amount of Co in the composition, i.e., $(Ni - Co)^2$, is less than 1.8. Also, claim 1 requires that the ratio of the amount of Mo to the amount of Mo combined with one-half of the amount of W, i.e. Mo/(Mo+0.5W) be greater than or equal to 0.75. Claim 1 further requires that the amount of Ni is not more than values determined by a straight line drawn on a point A (1.0, 2.7%) and a point B (2.5, 1.0%) in the orthogonal coordinates as shown in drawing Fig. 2 of the present application. This figure illustrates the relationship between the square value to the amount of Ni in the claimed composition. None of these claimed features of the invention are disclosed or suggested in any of the prior art relied upon by the Examiner.

The Office Action refers to Specimen 11 in Table 1 on page 284 of the Tanaka et al. published application attached to the abstract as meeting the requirements of claim 1. In Specimen 11, assuming that the amounts of the steel, including the balance of Fe, add up to 100%, the amount of Ni is 1.35 g, the amount of Co is 1.05 g, the amount of Mo is 1.98 g and the amount of W is 0.5 g. Thus, Mo/(Mo + 0.5W) is 1.98[1.98+[(0.5)(0.5)]] or 1.98 (1.98 + 0.25) or 4.4. This value is greater than 0.75. The $(Ni-Co)^2$ is $(1.35-1.01)^2$ or $(0.34)^2$ which is 0.12. This value is less than 1.8, however, the $(Ni-Co)^2$ value is not within points A and B of Fig. 2 as required by claim 1. In addition, Specimen 11 does not include Nb. Claim 1 requires 0.02 to 0.22% Nb. Tanaka et al. does not disclose or suggest adding Nb to the steel composition.

Gas turbine discs are subject to temperatures ranging from room temperature to 500°C. They are most subject to brittleness at temperatures from 450° C to 500° C. Tanaka et al. do not suggest or disclose the $(Ni-Co)^2$, Mo/(Mo+0.5W) and Fig. 2, points A and B, relationships as set forth in claim 1 to produce a heat resistant steel having the improved high temperature strength, high creep rupture strength, and reduced brittleness at gas turbine operating temperatures.

A comparison of the compositions outside the claimed composition (Specimens 1-6) to compositions within the scope of claim 1 (Specimens 7, 8, 10 and 13) is disclosed at pages 19-22 of the specification. As described on pages 20 and 21 of the specification, Specimens 7, 8, 10 and 13 which are directed to the invention have high impact strength for operating at high gas turbine temperatures and are less subject to brittleness at 510° C after 10^5 hours. Specimens 1 and 3-6 do not meet all of the requirements of the claimed invention and do not satisfy the mechanical properties required by gas turbine disks as set forth page 20 of the specification.

As for Hamada et al., this reference also does not disclose or suggest the relationships of $(Ni-Co)^2$ and Fig. 2, points A and B, with respect to achieving the mechanical properties of high temperature strength, high creep rupture strength, and reduced brittleness at high gas turbine operating temperatures. The relationship of Ni, Co and Cu is disclosed, but not $(Ni-Co)^2$. While Hamada et al. discloses a relationship between Mo and W as Mo+W/2, the reference does not disclose or suggest the relationship of Mo/(Mo+0.5W) required by claim 1.

The Office Action relies on Specimen 31 in Hamada et al. Taking the percentages disclosed in Specimen 31, the Mo/(Mo+0.5W) ratio is 1.4 and $(Ni-Co)^2$ is $(1.10-1.53)^2$ or

$(-0.43)^2$ or 0.18. While the specimen appears to meet the $(Ni-Co)^2$ requirement and the Mo/(Mo+0.5W) ratio, the $(Ni-Co)^2$ value is not within points A and B of Fig. 2 and the specimen does not include 0.02 to 0.22% Nb, both of which are required by claim 1. Moreover, Hamada et al. are preparing heat resistant steels having creep strength and toughness for operation in environments ≥ 625° C, such as for use in steam boilers, not gas turbines. The reference does not relate to low temperature toughness and reducing brittleness of the steel at gas turbine operating temperatures.

In the heat resistant steel of Hamada et al., Cu is positively added in order to make stable an austenite phase of the steel whereby restraining occurrence of a δ-ferrite phase. In the present invention, however, Cu is an impurity element which should be as small as possible because Cu enhances brittleness at gas turbine operating temperatures.

The Ishii et al. reference does not make up for the deficiencies of Tanaka et al. and Hamada et al. While Ishii et al. disclose a heat resistant steel with Nb, the composition does not satisfy the Mo/(Mo+0.5W) ratio, $(Ni-Co)^2$ and the Fig. 2 requirements of claim 1. See Table 1 on page 7 of Ishii et al., test sample 10, which is the only sample containing both Ni and Co. The Mo/(Mo+0.5W) ratio is 0.09 which is not more than 0.75; $(Ni-Co)^2$ value is 13.0, which is not less than 1.8; and the Ni content and $(Ni-Co)^2$ value do not fall within points A and B of Fig. 2. In addition, the amount of Ni in the sample is outside the claimed range and not between points A and B in Fig. 2.

The Examiner relies on Ishii et al. as teaching that it would be within the skill of the art to add Re to a heat resistant steel to improve toughness. The reference teaches adding B to heat resistant steel to promote deposition of precipitates in the crystal grain boundaries and to enable

the carbide and/or nitride to remain stable after exposure to high temperatures for a long period of time. Despite these disclosures, the reference does not disclose or suggest a recognition of the Mo/(Mo+0.5W) ratio, $(Ni-Co)^2$ as well as the Fig. 2 relationships set forth in claim 1 to provide low temperature toughness and reduce brittleness of the steel at gas turbine operating temperatures.

For all of the foregoing reasons, the Tanaka et al., Hamada et al. and Ishii et al. references, taken alone or in combination, fail to present a *prima facie* case of obviousness of claim 1. Since claims 3 and 8 are dependent on claim 1, they too would not be obvious. Accordingly, it is respectfully requested that the rejections of claims 1, 3 and 8 under 35 U.S.C. § 103(a) be reconsidered and withdrawn.

Conclusion

For the foregoing reasons, it is submitted that the claims 1, 3 and 8 are patentable over the teachings of the prior art relied upon by the Examiner. Accordingly, favorable reconsideration of the claims is requested in light of the preceding amendment to claim 1 and remarks. Allowance of the claims is courteously solicited.

If there are any outstanding issues that might be resolved by an interview or an Examiner's amendment, the Examiner is requested to call Applicant's attorney at the telephone number shown below.

To the extent necessary, a petition for an extension of time under 37 C.F.R. § 1.136 is hereby made. Please charge any shortage in fees due under 37 C.F.R. § 1.17 and due in

connection with the filing of this paper, including extension of time fees, to Deposit Account 500417 and please credit any excess fees to such deposit account

Respectfully submitted,

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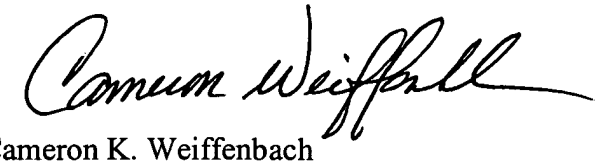

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